

REMARKS

Responsive to the Office Action mailed 28 April 2008 and with an extension of time of ONE MONTH, the fee for which is paid herewith, the present paper is timely filed on or before 28 August, 2008.

By the present paper, no claims are cancelled, claims 17, 18, 21, 28, and 29 are amended, and new claims 31 - 36 are added. Claims 1 - 10 were previously cancelled. Accordingly, claims 11 - 36 are in the Application.

Entry of the amendments, entry of the new claims, and reconsideration of the Application are respectfully requested.

The Claim Amendments:

Claims 17, 21, and 29 were amended to correct matters of form. Applicants respectfully submit that support for the amendment can be found, for example, in the claims themselves.

Claim 28 was amended to correct an obvious scrivener's error.

Claims 11 and 18 were amended to point-out with even greater particularity that which Applicants consider as their invention by reciting the requirement that at least one of compound A or B (or C) must have more than two functional groups (e.g. amino in the case of compound B). Support for the amendments can be found in the specification at, for example, the examples, as shown in Appendix A hereto¹.

Applicants respectfully submit that the claim amendments do not introduce new matter into the Application.

The New Claims:

New claims 31, 32, and 33 depend from claim 11 and recite specific species of compound A. Support for new claims 31, 32, and 33 can be found in

¹ In Appendix A, the functionality of the reagents is given in parenthesis.

the specification at, for example, page 10, Examples 1-1 to 1-21, and Examples 2-1 to 2-19.

New claims 34 and 35 depend from claim 11 and recite specific species of compound B. Support for new claims 34 and 35 can be found in the specification at, for example, pages 11 -12 and Examples 1-1 to 1-19.

New claim 37 depends from claim 18 and recites specific species of compound C. Support for new claim 37 can be found in the specification at, for example, Examples 2-1 to 2-19.

Applicants respectfully submit that the new claims do not introduce new matter into the specification.

The Claim Objections:

Claims 17, 21, and 29 were objected to as allegedly being in improper form. Applicants respectfully submit that the present amendments overcome the objections.

Claim Rejections Under 35 U.S.C. § 112:

Claim 28 was rejected under 35 U.S.C. § 112 because the term “heterocyclic compound” allegedly lacked proper antecedent basis. Applicants respectfully submit that the present amendments to claim 28 render the rejection moot.

Claim Rejections Under 35 U.S.C. § 102:

Claims 11, 14-17, and 24 - 29 were rejected under 35 U.S.C. § 102(b) as allegedly anticipated by Wariishi et al. U.S. Patent 6,376,765 (Wariishi et al.). Because Wariishi et al. do not teach all of the elements (limitations) of Applicants’ claim 11, Applicants respectfully traverse.

In order to anticipate a claim, a prior art reference must teach all of the elements (limitations) of the claim, arranged as required by the claim. M.P.E.P § 2131. The embodiment of Applicants’ inventive dye-sensitized solar cell

described by claim 11 includes, *i.a.*, an electrically-conductive substrate disposed opposite to an electrically-conductive membrane that is on the surface of a transparent substrate (emphasis added). Accepting, *arguendo*, the Office's characterization of the elements of Wariishi, Applicants respectfully call the Office's attention to the fact that the "top transparent substrate 50a", of Wariishi is neither taught nor suggested to be conductive and, therefore, cannot be in any way equivalent to applicants' electrically conductive substrate.

Because Wariishi et al. do not suggest let alone teach an electrically-conductive substrate disposed opposite to an electrically-conductive membrane that is on the surface of a transparent substrate, Wariishi et al. do not teach all of the elements of Applicants' claim 11, arranged as required by the claim. For at least this reason, Applicants respectfully submit that the rejection of claim 11 is improper and should be withdrawn.

But Applicants do not base their traversal on the foregoing grounds alone. The crosslinked polymer of the electrolyte of Wariishi et al. is obtained by reacting a reagent reactive to a nitrogen atom with a nitrogen-containing polymer, in which the N-atom is in a heterocyclic group that is *pendant* to the main chain (or backbone) of the nitrogen-containing polymer (Wariishi et al. at 21:44-57). The reagent reactive to the heterocyclic nitrogen can be an isocyanate.

Applicants respectfully submit that, contrary to assertions in the Office Action, the nitrogen atoms in the pendant heterocyclic groups in the polymers of Wariishi et al. are not "amino groups" as the skilled artisan would understand that term in Applicants' claims.

Applicants respectfully submit that the skilled artisan reading Applicants' entire disclosure would instantly recognize that "amino group" in Applicants' claims refers to the —NH_2 substituent. In support of this position, Applicants attach as Appendix B the relevant pages from a treatise on organic chemistry, showing that, historically, "amino group" refers to —NH_2 . Accordingly, Wariishi et al. cannot be said to teach reaction of a multifunctional isocyanate with a

multifunctional amine, as the skilled artisan would understand “amine” in the context of Applicants’ claims. For this additional reason, Applicants respectfully submit that the rejection of claim 11 is improper and should be withdrawn.

Concerning claims 14 - 17, these claims depend from claim 11 and further limit the subject matter thereof. Because, as Applicants respectfully submit, claim 11 contains patentable subject matter, claims 14 - 17 likewise contain patentable subject matter. Accordingly, Applicants respectfully submit that the rejection of claims 14 - 17 is improper and should be withdrawn.

Concerning claims 24 -29, these claims also depend from claim 11 and, for the reasons just discussed with respect to the rejection of claims 14 -17, Applicants respectfully submit that the rejection of claims 24 - 29 is improper and should be withdrawn.

Claim Rejections Under 35 U.S.C. § 103:

Claims 12 and 13 were rejected under 35 U.S.C. § 103(a) as allegedly obvious over Wariishi et al. in view of Takaoka et al., U.S. Patent 6,589,383 (Takaoaka et al.). Because neither Wariishi et al. nor Takaoaka et al., alone or in combination, teach or suggest all of the elements (limitations) of Applicants claims, Applicants respectfully traverse.

Claims 12 and 13 depend from claim 11. Because, as Applicants respectfully submit, claim 11 contains patentable subject matter, claims 12 and 13 likewise contain patentable subject matter. Accordingly, Applicants respectfully submit that the rejection is improper and should be withdrawn.

Claims 18 - 23 were rejected under 35 U.S.C. § 103(a) as allegedly obvious over Wariishi in view of Yamaguchi, JP 2002-184478 (Yamaguchi). For at least the reasons discussed in relation to the rejection of claim 11 under 35 U.S.C. § 102, *supra*, Applicants respectfully submit that independent claim 18 contains patentable subject matter and, accordingly, that dependent claims 19 - 23 likewise contain patentable subject matter. Accordingly, Applicants respectfully

submit that the rejection is improper and should be withdrawn.

Furthermore, Takaoaka et al. is directed to conductive materials for batteries, an application where optical transparency is, at least in the first instance, wholly irrelevant. The skilled artisan of the day would have looked to Takaoaka et al. for guidance in constructing batteries, not for guidance in constructing a solar cell having an electrically-conductive substrate to dispose in opposition to an electrically conductive membrane. Batteries store energy. Solar cells generate energy. A conductive gel for the one does not suggest a conductive gel for the other.

Moreover, except for three brief paragraphs ([0047], [0048], and [0049]) Yamaguchi, directed to photoelectric conversion elements, is essentially devoid of any teaching on the juxtaposition and relationship between the structural elements of photoelectric conversion elements.

Accordingly, Applicants respectfully submit that neither Wariisi et al. nor Takaoaka et al. nor Yamagucci, alone or in any combination or permutation, teach or suggest all of the elements of Applicants claims 18 - 23. For this additional reason, Applicants respectfully submit that the rejection of claims 18 - 23 is improper and should be withdrawn.

Turning next to claim 30, claim 30 was rejected under 35 U.S.C. § 103(a) as allegedly obvious over Wariishi, as applied to claim 11, in view of Sugihara et al., U.S. Patent 6,274,806. Claim 30 depends from 11. Because, as Applicant respectfully submit, claim 11 contains patentable subject matter, claim 30 likewise contains patentable subject matter. Accordingly, Applicants respectfully submit that the rejection of claim 30 is improper and should be withdrawn.

Provisional Double Patenting Rejection:

Claims 1 - 23 were provisionally rejected for non-statutory obviousness-type double patenting as allegedly obvious over claims 14 - 22, 32 - 43, and 50 - 63 of copending United States Patent Application 10/473,464. Claims 24 - 29 were provisionally rejected for non-statutory obviousness-type double patenting as allegedly obvious over claims 14 - 22, 32 - 43, and 50 - 63 of copending United States Patent Application 10/473,464.

Applicants respectfully point-out that the scope of claims 14 - 22, 32 - 43, and 50 - 63 of copending United States Patent Application 10/473,464 is yet to be determined. Accordingly, Applicants respectfully defer addressing this rejection until the content of claims 14 - 22, 32 - 43, and 50 - 63 of copending United States Patent Application 10/473,464 is determined.

Conclusion:

Based on the foregoing amendments and remarks, Applicants respectfully submit that the claims are now in condition for allowance, which allowance is earnestly solicited.

If, in the opinion of the Examiner, a telephone conference would advance prosecution of the Application, the Examiner is invited to telephone the undersigned attorneys.

CLAIM FEES

Three claims in excess of twenty are added. The fee of \$150 for the claims is provided for in the charge authorization presented in the PTO Form 2038, Credit Card Payment form, provided herewith.

REQUEST FOR EXTENSION OF TIME

Applicants respectfully request a one month extension of time for responding to the Office Action. The fee of \$120 for the extension is provided for in the charge authorization presented in the PTO Form 2038, Credit Card Payment form, provided herewith.

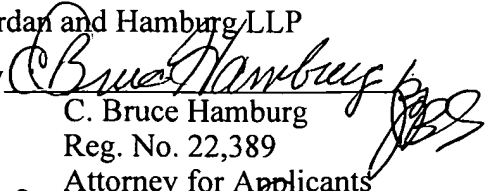
AUTHORIZATION TO DEBIT

If there is any discrepancy between the fee(s) due and the fee payment authorized in the Credit Card Payment Form PTO-2038 or the Form PTO-2038 is missing or fee payment via the Form PTO-2038 cannot be processed, the USPTO is hereby authorized to charge any fee(s) or fee(s) deficiency or credit any excess payment to Deposit Account No. 10-1250.

Respectfully submitted,

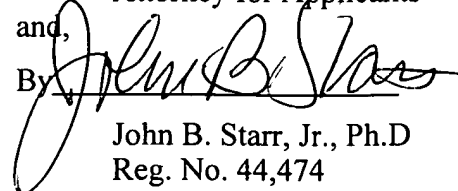
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enc: Appendix A, Appendix B and PTO Form 2038

Appendix A

* A numeral in a parenthesis denotes a number of functional groups.

[Example 1-1]

A: polytetramethylene glycol (4) + tolylene diisocyanate (TDI) (Synthesis method 1-1)

B: diethyltoluene diamine (2)

[Example 1-2]

A: trimethylolpropane-denatured tolylene diisocyanate (Coronate L) (3)

B: polyetheramine (Jeffamine T-5000) (3)

[Example 1-3]

A: glycerin + ethylene oxide/propylene oxide (EO/PO) copolymer + TDI (Synthesis method 1-2) (3)

B: polyetheramine (Jeffamine T-5000) (3)

[Example 1-4]

A: glycerin + ethylene oxide/propylene oxide (EO/PO) copolymer + TDI (Synthesis method 1-2) (3)

B: polyetheramine (Jeffamine T-5000) (3)

[Example 1-5]

A: tolylene diisocyanate (2)

B: polyetheramine (Jeffamine T-3000) (3)

[Example 1-6]

A: diglycerin + EO/BO copolymer + TDI (Synthesis method 1-3) (4)

B: dimethylthiotoluenediamine (2)

[Example 1-7]

A: isophorone diisocyanate (IPDI) (2)

B: polyetheramine (Jeffamine T-5000) (3)

[Example 1-14]

A: glycerin + EO/PO copolymer + TDI (Synthesis method 1-2) (3)

B: polyetheramine (Jeffamine D-400) (2)

[Example 1-16]

A: sorbitol + EO/PO copolymer + TDI (Synthesis method 1-10) (6)

B: diethyltoluene diamine (2)

[Example 1-18 ~ 1-21]

same as Example 1-4

[Example 2-2]

A: tolylene diisocyanate (2)

C: glycerin + PO (Synthesis method 2-2) (3)

C: ethylene glycol + EO/PO copolymer (Synthesis method 2-3) (2)

[Example 2-6]

A: polytetramethylene glycol+ tolylene diisocyanate (TDI) (Synthesis method 2-7) (4)

C: polyether-modified polycarbonate diol (2)

[Example 2-8]

A: ethyleneglycol + EO/PO copolymer +Hexamethylene diisocyanate (HMI) (Synthesis method 2-8) (2)

C: glycerin+ PO (Synthesis method 2-2) (3)

[Example 2-15]

A: trimethylolpropane-denatured tolylene diisocyanate (Coronate-L) (3)

C: polyethyleneglycol (Synthesis method 2-4) (2)

[Example 2-16 ~ 2-19]

same as Example 2-9

3rd Edition

CHEMISTRY
of
ORGANIC
COMPOUNDS

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CHAPTER FOURTEEN

ALIPHATIC NITROGEN COMPOUNDS

Structurally the organic oxygen compounds have been considered as derivatives of the water molecule. Similarly many of the organic nitrogen compounds may be considered as ammonia molecules, the hydrogen atoms of which have been replaced by other groups. Since nitrogen has three replaceable hydrogens instead of two as in water, the number of possible combinations is increased.

H ₂ O	water	NH ₃	ammonia
ROH	alcohols	RNH ₂	primary amines
		R ₂ NH	secondary amines
ROR	ethers	R ₃ N	tertiary amines
RCOOH	acids	RCONH ₂	amides
		RC(NH)NH ₂	amidines
RCOOR	esters	RCONHR	N-alkyl amides
		RCONR ₂	N,N-dialkyl amides
		RC(NH)OR	imidic esters
RCOOCOR	anhydrides	RCONHCOR	imides
RCH=O	aldehydes	RCH=NH	aldimines
R ₂ C=O	ketones	R ₂ C=NH	ketimines

This list is not complete, but contains the types of compounds most frequently encountered. Substituents on nitrogen other than hydrogen, alkyl, and acyl also may be present as for example in the cyanides (p. 274), the isocyanides (p. 278), the oximes (p. 233), the hydrazones (p. 234), and the nitro compounds (p. 279).

AMINES

Nomenclature

Aliphatic amines are alkyl substitution products of ammonia and are named as such, ammonia being contracted to *amine*.¹ Thus CH₃NH₂ is methylamine, (CH₃)₂NH is dimethylamine, and (CH₃)₃N is trimethylamine. With mixed amines the alkyl groups frequently are named in the order of increasing complexity, for example CH₃(C₂H₅)NCH(CH₃)₂ is methylethyl-*i*-propylamine. Compounds in which the nitrogen atom is united to one carbon atom, RNH₂, are called *primary amines*; to two carbon atoms, R₂NH, *secondary amines*; and to three carbon atoms, R₃N, *tertiary amines*. The terms *primary*, *secondary*, and *tertiary* refer here to the condition of the nitrogen atom, whereas when used with alcohols they refer to the carbon atom to which the hydroxyl group is attached. Thus although tertiary butyl alcohol, (CH₃)₃COH, is a tertiary alcohol, because the carbon atom is united to three other carbon atoms, tertiary butylamine, (CH₃)₃CNH₂, is a primary amine, because the nitrogen atom is united directly to only one carbon atom. When referring to the type of alkyl group in primary amines it is convenient to use the term *carbinamine* in analogy to the term *carbinol* despite the recommendation to discontinue the use of the latter term. Thus ethylamine is a

¹Cf. footnote 4, p. 233.

CHAPTER 14. — A

primary carbinamine
tertiary carbinamine
amino group, and
named as amino-1-

Preparation

MIXED PRIMARY,

1. *From Alkyl*
isocyanates (p. 3)
by the reaction of
philic attack on
substituted amine

This initial reaction
ammonia present
primary amine for

The primary amine
a molecule of a
amine.

Immediately a tri-

Finally a single-

The reaction scheme
quaternary amine
can be transferred

Accordingly
for preparing amine
salts, and the quaternary
tion liberates a
affected. It is possible
ammonia is used
greater than the
If increasing an

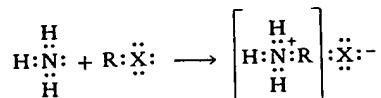
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Liebig, and
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primary carbinamine, isopropylamine is a secondary carbinamine, and *t*-butylamine is a tertiary carbinamine. All carbinamines are primary amines. The NH_2 group is called the *amino group*, and primary amines having other functional groups conveniently may be named as amino substitution products; for example, $\text{CH}_3\text{CHNH}_2\text{CH}_2\text{CH}_2\text{OH}$ could be called 3-amino-1-butanol.

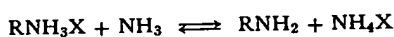
Preparation

MIXED PRIMARY, SECONDARY, AND TERTIARY AMINES

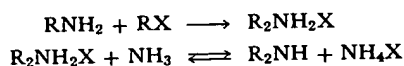
1. *From Alkyl Halides and Ammonia.* Wurtz prepared the first amines from alkyl isocyanates (p. 339) in 1849, but the most direct method for the preparation of amines is by the reaction of ammonia with an alkyl halide, reported by Hofmann² in 1850. Nucleophilic attack on carbon by the ammonia molecule displaces halide ion to give an alkyl-substituted ammonium halide.



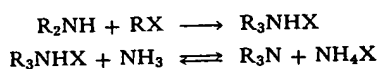
This initial reaction, however, is followed by a series of secondary reactions. The excess of ammonia present while the alkyl halide is reacting with ammonia competes with the primary amine for the hydrogen halide.



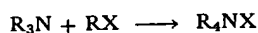
The primary amine thus formed also has an unshared pair of electrons and can react with a molecule of alkyl halide, giving rise to another pair of reactions to form a secondary amine.



Immediately a third pair of reactions is possible giving a tertiary amine.



Finally a single further reaction can take place giving a quaternary ammonium salt.



The reaction stops at this point, because there is no hydrogen attached to nitrogen in the quaternary ammonium salt (nitrogen united to four carbon atoms), and hence no proton can be transferred to another base.

Accordingly the reaction of alkyl halides with ammonia, known as the *Hofmann method for preparing amines*, gives rise to a mixture of primary, secondary, and tertiary amines, their salts, and the quaternary ammonium salt. Addition of strong alkali at the end of the reaction liberates a mixture of the free amines from their salts, but the quaternary salt is not affected. It is possible to control the reaction to a certain extent. If a very large excess of ammonia is used, the chance that the alkyl halide will react with ammonia molecules is greater than that it will react with amine molecules, and chiefly primary amine is produced. If increasing amounts of alkyl halide are used, more of the other products are formed.

² August Wilhelm Hofmann (1818-1895), German chemist who received his training under Liebig, and who was professor at the Royal College of Chemistry in London from 1845 to 1864, and at the University of Berlin from 1864 until his death. He is noted particularly for his work on amines and for his investigations of aromatic compounds. The latter work laid the basis for the coal tar chemical industry.